Serial #:

# UNIVERSITY OF BAHRAIN
# COLLEGE OF INFORMATION TECHNOLOGY
# DEPARTMENT OF COMPUTER SCIENCE

## ITCS 385 – Database Systems

## Midterm
## Semester I, 2013-2014

Date: Thursday, November21st, 2013 Time: 3:00pm - 4:30pm

| | |
|---|---|
| **Name** | |
| **Student I.D.** | |
| **Section** | [1] UTH 09:00 – 09:50<br>[2] UTH 10:00 – 10:50 *Please tick one*<br>[3] UTH 12:00 – 12:50 |

| | | |
|---|---|---|
| Question 1 (PART A) | 9 | 7 +2 ← please have a look |
| Question 1 (PART B) | 9 | 9 |
| Question 2 | 12 | 11.5 |
| Question 3 | 12 | 8.5 +1 ← |
| Question 4 | 8 | 7.5 |
| TOTAL | 50 | ~~43.5~~ 46.5 OK 1/12/2013 |

**Notes:**

1. Your answers must be written on the question paper and in the place allocated. Any answer written on any other place will not be marked.
2. Use the back of the pages for any rough work, BUT remember rough work will not be marked.
3. Do not give more than one answer (alternative solutions) to the same question; if you do so then only the first answer will be marked.
4. **Switch off your mobile** and keep it in your pocket or bag.

**Question 1**
**PART A [ 3 + 3 + 3 = 9 marks ]**

1. **Define the following terms:**

**DBMS:** Collection of programs to create and maintain a Database, facilates the process of defining, Constructing, manipulating and sharing the database.

**DBA:** (Database Administrators) Workers on the scene, responsible of the overall control of the database at the technical level, and responsible of implemenating and maintaining the DB, he handles the security essues and programs the effeciency of the DB, and handles the Backup and recovery.

**Consider the following database schema for a car insurance company to answer Question (2) & (3):**

**Employee (ID, name, DepartmentID)**
**Department (ID, name, building)**

2. **Define the term 'Integrity Constraints'? Show two examples of integrity constraints for the company database above.**

[Definition]:

The entity integrity constraint means that the primary key cannot be null, The referential integrity constrains the foreign key either a NULL or a value of the corecponding primary key.

[Examples]:

1. The value of the attribute ID which is the primary key cannot be NULL Ex: <NULL, Ahmed, 1> is invalid.
2. If the Department ID have the values (1, 2, 3) then the Department ID in Employee cannot be any number other than 1, 2, 3 Ex: <1678, Ahmed, 4> is Invalid

3. **List two (2) different end users of the company database, to which user category would each belong (explain why)?**

[User 1]:

Sophisticated End users, for example the buisness analysts that provide complex statistics for the company, and implement complex Qyieries in the DB.

Examples?

[User 2]:

Casual end users, they ocasionally access the database and they may need different informations each time like the middle or high-level managers and ocasional browsers

please re-check

**Question 1**
**PART B [ 3+ 6 = 9 marks ]**

1. **Define the following terms:**

**DDL:** Data Definition language, the DB administinator and designer specifies the conseptual and internal schema using it, like the attributes, entities and relationships for conseptual, and indexes access path and datatypes for internal.

1.5

**Data Independence:** ability to make changes at a schema level without having to change the next higher level, only mapping between this level and the next higher level need to be changed. Therefore, the application program doesn't have to change.

1.5

2. **Briefly explain the centralized and three-tier client/server architectures. Also, for each of the two architectures, give one example of a database system that would be appropriate for.**

Centralized: all database functionalities, application programs execution and interfaces processing carried out on one machine for example a single mainframe with number of termenals attached. example DB? -1

2

Three-tier client/server architectures: To deal with large number of workstations, PC's and printers. The idea is to provide servers with special functions like the file server for maitaining client files, the web or Email server, and the printers server that is attached to number of printers and all printing requests goes to this server.

2

The first tier is the client, the seconed tier (intermediate) is the application or web server that includes the connectivity and buisness logic (and process the data between the client and the server), and the third tire is the server that access the DB

1

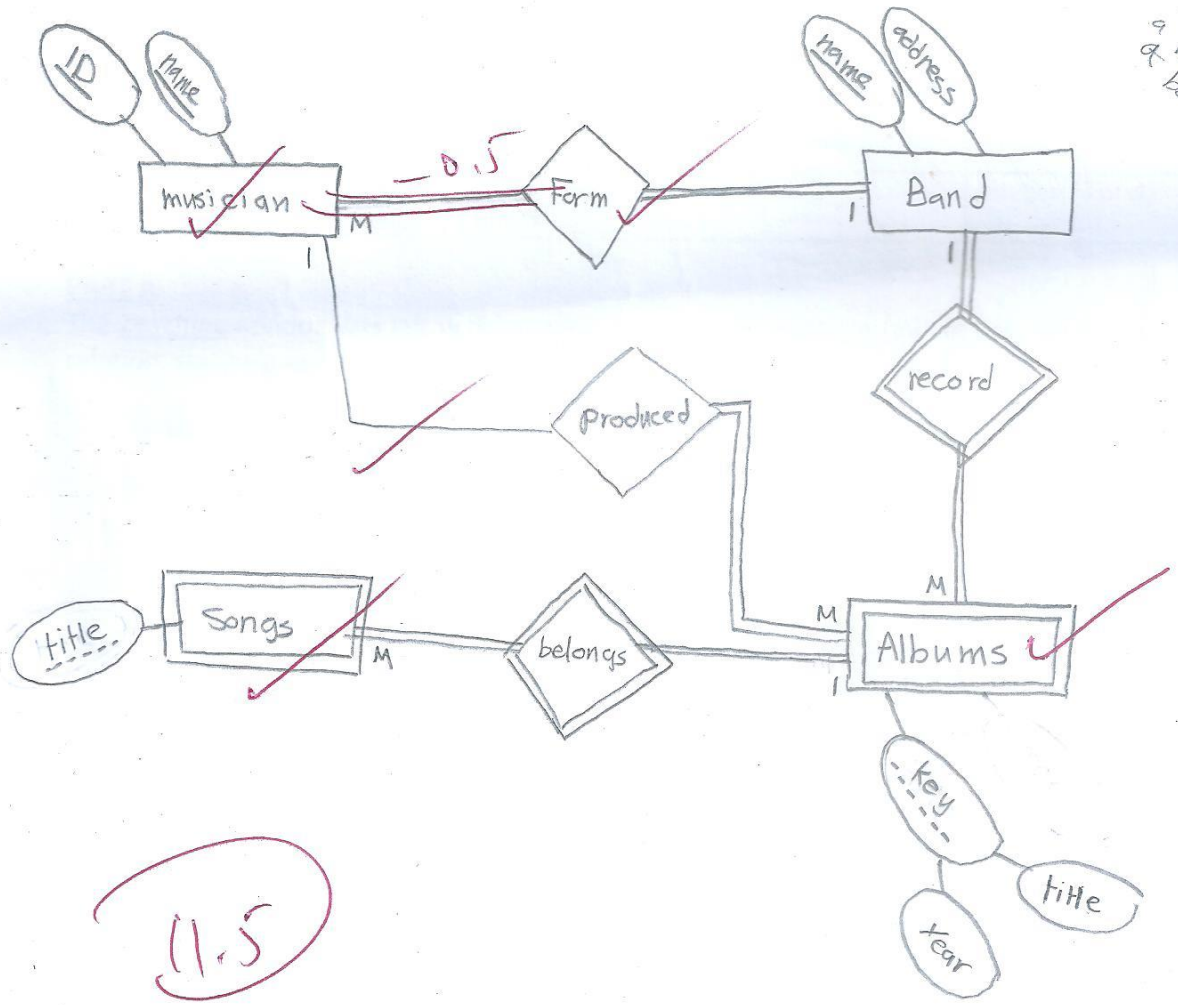
The three tier can enhance security because the client cannot access the database directly and the database is only accessed by the seconed tier. As an example - the web applications usually use third tier architectures. (Amazon.com)

**Question 2 [ 12 marks ]**

A recording studio needs your help to design its database. The studio stores information about musicians and albums. Draw an ER diagram describing the studio's database for the scenario described below. Note any unspecified requirements, and make appropriate assumptions to make the specification complete.

Each musician who records at the studio has a unique ID and a name, and no two musicians have the same name. Musicians form bands. A band is described by a unique name and has an address. Each band has at least one musician as a member but a musician should be a member of exactly one band. Bands record albums, which have a title and a year of production. Each album is recorded by exactly one band, and no two albums (for the same band) have the same title and the same production year. Each album is produced by exactly one musician. It is not necessary that the producer musician is a member of the recording band. Albums are made up of songs, described by their titles. Naturally, each song belongs to exactly one album, and all songs on the same album have different titles.

∴ not every musician in DB is a member of a band.




11.5

**Question 3 [ 3 + 3+ 6 = 12 marks ]**

Consider the following database state and data definition for a university database. The database keeps track of the university instructors, courses, departments and the courses taught by instructors each semester and each year.

**Instructor**

| instructorID | instructorName | deptID |
|---|---|---|
| 100 | Dr. Adam | 51 |
| 200 | Dr. Jim | 31 |

**Course**

| courseNo | courseName | credits | offeringDeptID |
|---|---|---|---|
| 501 | Programming I | 3 | 51 |
| 301 | Database II | 4 | 51 |
| 521 | Math I | 3 | 31 |

**Teaching**

| instructorID | courseNo | Sem | Year | sectionNo | roomNo |
|---|---|---|---|---|---|
| 100 | 501 | 1 | 2012 | 1 | S101 |
| 100 | 501 | 2 | 2012 | 2 | S105 |
| 200 | 521 | 1 | 2013 | 3 | S104 |

**Department**

| deptID | deptName | collegeName |
|---|---|---|
| 51 | CS | IT |
| 31 | Math | Science |

| Attribute | Format |
|---|---|
| instructorID, courseNo deptID, instructorID offeringDeptID, sectionNo | Integer |
| Year | Integer: four digits. |
| Sem | Integer: { 1 or 2} |

| Attribute | Format |
|---|---|
| courseName, instructorName deptName, collegeName, roomNo | Characters: max size 25 |
| credits | Integer: {3 or 4} |

**PART A**

The *Teaching* relation was left with no primary key. Specify an appropriate primary key for this relation, stating any assumption you make.

(instructorID, courseNo, Sem, year)

assumption : ~~each instructor teaches only one course in every Sem and year~~. ( The instructor cannot teach two sections for a specified course, Sem and year)

diff

student stated her assumption her!

**PART B**

Specify the foreign keys for each relation above, stating any assumption you make.

| Relation | Foreign Key(s) |
|---|---|
| **Instructor** | dept ID |
| **Course** | offering Dept ID |
| **Teaching** | instructorID / courseNo / |
| **Department** | — |

**PART C**

**Suppose that each of the following operations is applied directly to the University Database. For each operation, indicate whether this operation will be successful (i.e. will lead to a valid relation state or not), if not, specify the reason(s).**

3.5

a. `insert into Department values (52, NULL, 'Science');`

**Successful operation:** (YES / (NO))

**If NO, WHY** Domain constraint, attribute value must be an anomic value that satisfies the allowable values in the Domain.

b. `DROP TABLE Teaching;`

**Successful operation:** (YES / NO)

**If NO, WHY** no foreign key reffering to the table.

c. `insert into Course values (503, 'Programming III', 2, 50);`

Domain

**Successful operation:** (YES / (NO))

**If NO, WHY** Referential integrity constraints, the offering department is a foreign key it can be either a null or a value of the corresponding primary keys, and 50 is not a value in the primary key (it should be either 51 or 31).

**Question 4 [3 + 2 + 3 = 8]**

**Consider the university database in Question (3) to answer the following SQL questions.**

1. **Create the *Department* relation.**

```
Create table Department (
    deptID Number(10),
    deptName Varchar2(25),
    collegeName Varchar2(25)
    );
```

2. **Change the collegeName from 'IT' to 'Information Technology'.**

```
Update table department
Set collegeName = 'Information Technology'
Where deptID = 51;
```

-0.5

3. **List the courseNo, sectionNo and roomNo of all courses taught in year 2012 by instructorID=100 in ascending order by courseNo.**

```
Select courseNo, sectionNo, roomNo
From Teaching
Where year = 2012 AND instructorID = 100
order by courseNo asc;
```